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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

S-386 United States Employment Service Technical Report October 1966

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Development of USES Aptitude Test Battery for Inspector And Machine Operator, Diode Subassemblies

(electronics) 726.685

U.S. DEPARTMENT OF LABOR
W. Willard Wirtz, Secretary
MANPOWER ADMINISTRATION
BUREAU OF EMPLOYMENT SECURITY
Washington, D.C. 20210

Technical Report on Development of USES Test Battery

For .....

Inspector and Machine Operator, Diode
Subassemblies (electronics) 726.685

S-386

U. S. Employment Service
in Cooperation with
California State Employment Service

October 1966

FOREWORD

The United States Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

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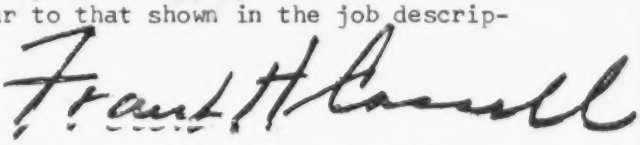
Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.



Frank H. Cassell, Director
U. S. Employment Service

GATB Study #2629

DEVELOPMENT OF USES APTITUDE TEST BATTERY

For

Inspector and Machine Operator, Diode Subassemblies (electronics) 726.685

S-386

This report describes research undertaken for the purpose of determining General Aptitude Test Battery (GATB) norms for the occupation of Inspector and Machine Operator, Diode Subassemblies (electronics) 726.685. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB, B-1002 Scores
P - Form Perception	90
K - Motor Coordination	105
M - Manual Dexterity	95

RESEARCH SUMMARY

Sample:

52 employed workers (all females) working as Inspectors and Machine Operators, Diode Subassemblies in Petaluma, California.

Criterion:

Supervisory ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses on aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .27 ($P/2 < .05$)

Effectiveness of Norms:

Only 65% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 74% would have been good workers. 35% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 26% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1.

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	65%	74%
Poor Workers	35%	26%

SAMPLE DESCRIPTION

Size:

N = 52

Occupational Status:

Employed Workers

Work Setting:

Workers were employed by GTI Components, Petaluma, California.

Employer Selection Requirements:

Education: Must be able to speak, read and write English. High school graduates preferred.

Previous Experience: None

Tests: Parts test devised by company consist of identification of 5 defects in 6 diode subassemblies.

Physical Requirements: Must pass Jenkel-Davidson and Bausch and Lomb Ortho-Rater vision tests.

Principal Activities:

The job duties for each worker in the final sample are comparable to those in the job description in the Appendix.

Minimum Experience:

All workers in the sample had three months experience, including 80 hours on-the-job training. Three months was considered the minimum experience necessary to attain job proficiency.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

	Mean	SD	Range	r
Age (years)	24.8	4.8	18-39	.137
Education (years)	11.2	1.4	8-15	-.062
Experience (months)	9.4	11.0	3-57	.253

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B, were administered April 1966.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as test data were collected. Two sets of ratings were made by each worker's immediate supervisor with a two-week interval between ratings.

Rating Scale:

An adaptation of USES Form SP-21, "Descriptive Rating Scale", was used. The scale (see Appendix) consisted of six items covering different aspects of job performance. Each item had five alternatives corresponding to different degrees of job proficiency.

Criterion Score Distribution:

Possible Range:	12-60
Actual Range:	26-60
Mean:	41.8
Standard Deviation:	7.1

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 35% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers." The criterion critical score was 40.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes P, K, F and M which do not have a high correlation with the criterion were considered for inclusion in the norms because the qualitative analysis indicated that they were important for the job duties; the sample had relatively high mean scores for P, K and F and a relatively low standard deviation for M. Aptitude Q which does not have a high correlation with the criterion was considered for inclusion in the norms because it had a relatively high mean score and low standard deviation. With employed workers, a relatively low standard deviation indicates that some sample pre-selection may have taken place and this restricted range of scores (low standard deviation) will depress the correlation between the aptitudes and the criterion. A relatively high mean score with employed workers may also indicate some sample pre-selection. Tables 3, 4 and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performed)

Aptitude	Rationale
P - Form Perception	Necessary to perceive detail in diode seals, to make visual comparisons and discriminations during the inspection process.
K - Motor Coordination	Necessary for coordinating eyes and fingers in rotating seals between thumb and fingers while inspecting seals and removing defective seals.
F - Finger Dexterity	Necessary for manipulating seals with the fingers and for using tweezers.
M - Manual Dexterity	Necessary for pouring beads and casings into hoppers, use of brush, pliers, air hose and oil can.

TABLE 4

Means, Standard Deviations (SD), Rnages and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Aptitude	Mean	SD	Range	r
G - General Learning Ability	94.4	15.2	58-119	.032
V - Verbal Aptitude	96.1	13.2	72-129	.142
N - Numerical Aptitude	92.3	16.2	52-132	-.102
S - Spatial Aptitude	102.5	17.8	71-140	.021
P - Form Perception	117.6	15.8	76-153	.136
Q - Clerical Perception	112.5	14.9	59-144	-.040
K - Motor Coordination	113.3	15.5	84-146	.031
F - Finger Dexterity	112.7	21.0	63-155	.112
M - Manual Dexterity	111.4	14.6	81-141	-.012

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important					X		X	X	X
Irrelevant									
Relatively High Mean					X	X	X	X	
Relatively Low Standard Dev.		X				X			X
Significant Correlation with Criterion									
Aptitudes to be Considered for Trial Norms					P	Q	K	F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of aptitudes P, Q, K, F, and M at trial cutting scores were able to differentiate between the 65% of the sample considered good workers and the 35% of the sample considered poor workers. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of P-90, K-105 and M-95 provided the highest degree of differentiation. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .27 (statistically significant at the .05 level).

TABLE 6

Concurrent Validity of Test Norms, P-90, K-105 and M-95

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	8	26	34
Poor Workers	9	9	18
Total	17	35	52

Phi Coeffieient (ϕ) = .27 Chi Square (X^2) = 3.748
Significance Level = $P/2 < .05$

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.

SP-21
Rev. 2/61

A-P-P-E-N-D-I-X

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR Inspector and Machine Operator, Diode Subassemblies (electronics) 726.685
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print) _____ _____
(Last) (First)

Sex: Male_____ Female_____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Performance is inferior and almost never meets minimum quality standards.

☐ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

☐ 3. Performance is acceptable but usually not superior in quality.

☐ 4. Performance is usually superior in quality.

☐ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Makes very many mistakes. Work needs constant checking.

☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Makes few mistakes. Work seldom needs checking.

☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

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FACT SHEET

Job Title: Inspector and Machine Operator, Diode Subassemblies (electronics) 726.685

Job Summary: Inspects diode seals at various stages of production to detect product defects; observes machine operations for proper flow of materials or machine malfunctioning; loads machine with parts and performs other related tasks.

Work Performed: Inspects product. Picks up small cup containing diode seals. Shakes cup to line up seals. Grasps seals by leads and removes from cup; holds 15 to 70 seals in one hand under strong light. Rotates seals between thumb and fingers of one hand, sometimes using thumb of other hand to aid in rotation, and visually inspects for burned casing or bead, chipped, broken or cracked glass on casing or bead, air between bead and wire or bead and casing, color of seal and bubbles. Pulls out defective seals with fingers and drops in scrap box or on floor. Puts acceptable seals in tray. When inspecting S bends, removes obviously defective products with tweezers; holds under microscope and visually inspects for such defects as improper alignment of "S" on wire or inaccurate width or elevation. Removes defective S bends with tweezers, drops in scrap box and puts acceptable S bends in metal scoop on balance scale.

Tends machines by loading, observing, and performing minor maintenance. Depending on machine tended, loads beads, casings and beaded leads: carefully pours beads from cellophane bag into vibrating hopper; pours casings from cellophane bag into wooden box with screen bottom; shakes box to screen out broken glass particles; carefully pours casings from box into vibrating hopper; pours beaded leads from plastic tray into vibrating hopper. Periodically observes automatic machine operations to determine if parts, such as beads, wire or casings are being placed properly, if gas jets are lighted, if materials are flowing smoothly through feed tubes, if wire is straight as it is being fed down to first dial head. Performs minor maintenance of machinery while it is in operation: removes bent wire leads from spindle or dial head with tweezers or small, needle-nosed pliers; when necessary, brushes away rejected leads, casings and debris from table and dial heads; uses air hose to blow out pieces of broken wire or ribbon from spindles when necessary. Uses oil can to fill cleaner cup with solution that cleans and lubricates wire as it is fed into machine. When feed tubes are jammed, taps with tweezers or brush. Lights gas burner if it goes out. When necessary, adjusts speed of vibration of hoppers by turning dial on front of machine. Periodically inspects a few seals before they enter oven to prevent oven from becoming loaded with rejects caused by machine malfunction. Attempts to detect faulty part of machine when it is malfunctioning to inform maintenance mechanic of problem. When rejects appear excessive, wire reel needs replacing, or machine is

malfunctioning, turns on switch to activate red light to signal maintenance mechanic. When necessary, shuts off machine by pushing switch or switches and shuts off gas valves by turning handle on pipe.

Performs any of the following related tasks: Weighs product trays to be filled during shift by placing each on balance scale, reads scale indicator and marks weight on side of tray with marking pencil; also marks date, customer's name, and the numbers of tray, shift, operator and machine. When using vials for final product, puts forty vials in wooden tray; places pre-printed labels on first and last vials in tray. Places row of vials in machine guide to be filled; when one vial is full, removes and pushes row forward. Puts cots on fingers to prevent wires from being tarnished during inspection process. Fills rack with diode seals for inspection by another inspector; takes a diode seal from each numbered spindle on dial head and puts in corresponding numbered space in rack. Reports number of acceptable seals examined to inspector who comes to machine hourly. Keeps daily record of time, in minutes, that machine is not functioning and what is wrong with seals or machine. Counts acceptable seals by placing tray on balance scale with predetermined weight on the other scale; fills tray until scales balance; removes tray and places it on one side of work table and places empty tray on scale. When using metal scoop as container on scale, pours products from scoop into vial; places vial in wooden tray and replaces empty scoop on scale for refilling. Stores trays of completed diode seals on storage shelf. Sweeps area around machine when necessary. Occasionally trains inexperienced workers to tend machine and inspect seals.

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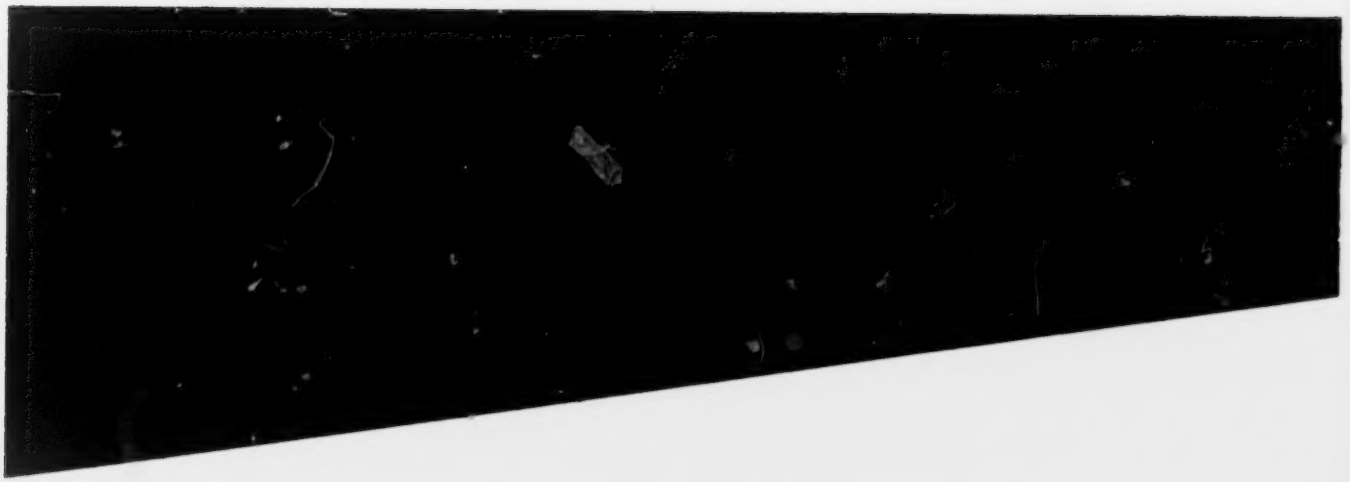

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